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(54) **MATERIAL FOR MECHANICAL SKIN
RESURFACING TECHNIQUES**

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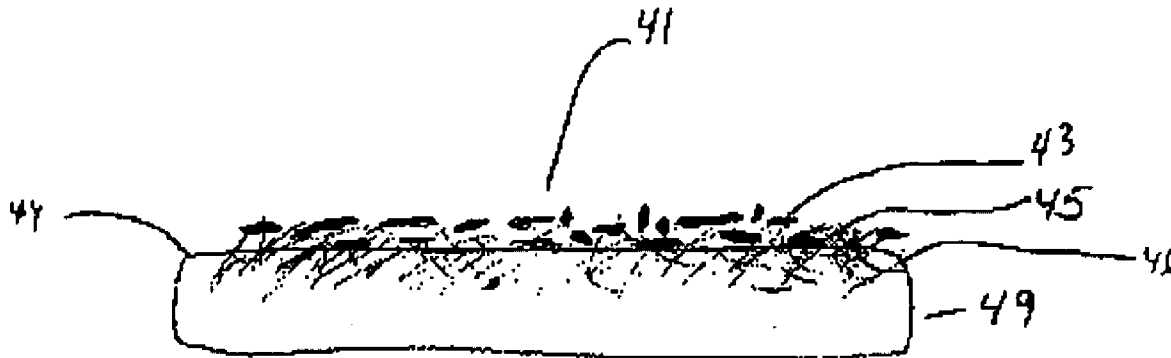
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(57) **ABSTRACT**
An article such as a disposable pad suitable for transferring
mechanical energy from a handheld device to skin placed in
contact with the article. The article has properties to reliably
transfer mechanical energy to the skin, including one or
more of Abrasiveness, Compressibility, Displacement, and
Surface Roughness.

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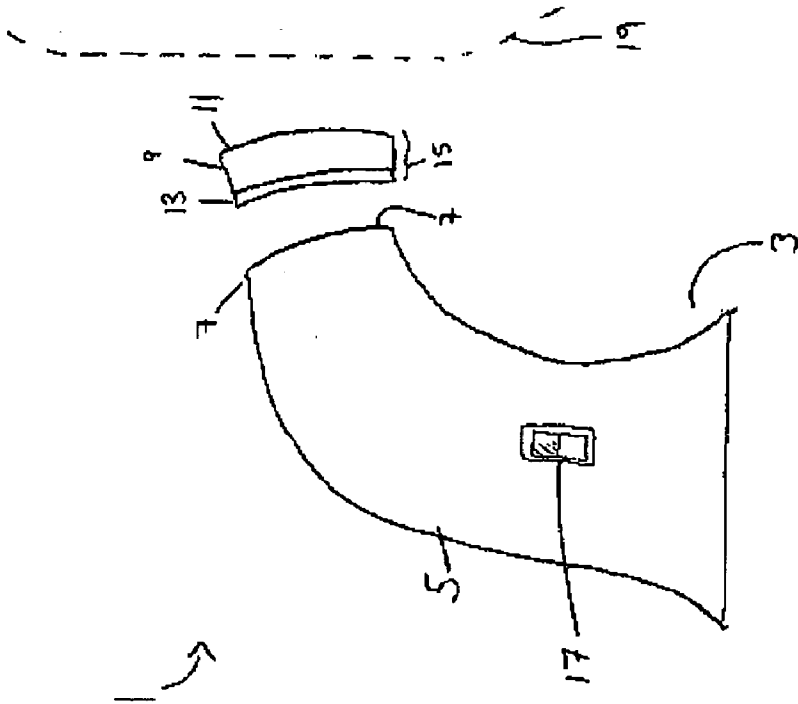


FIGURE 1

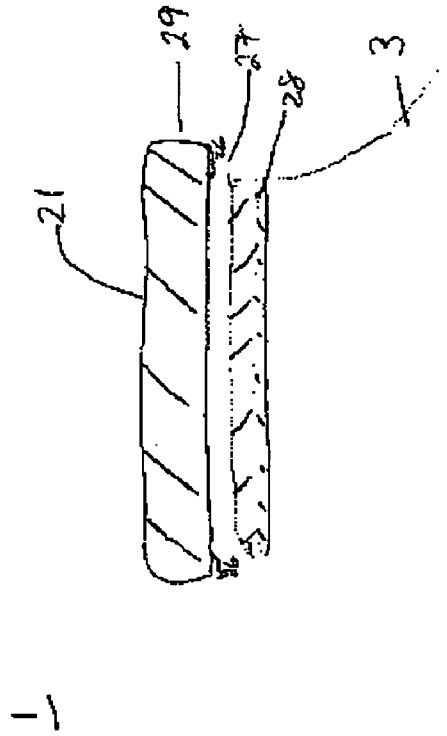


FIGURE 2

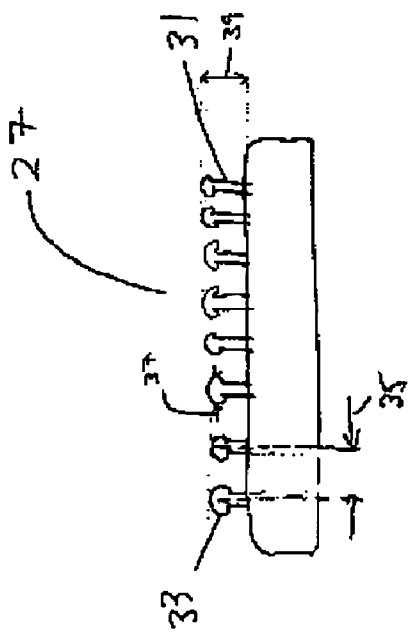


FIGURE 3a

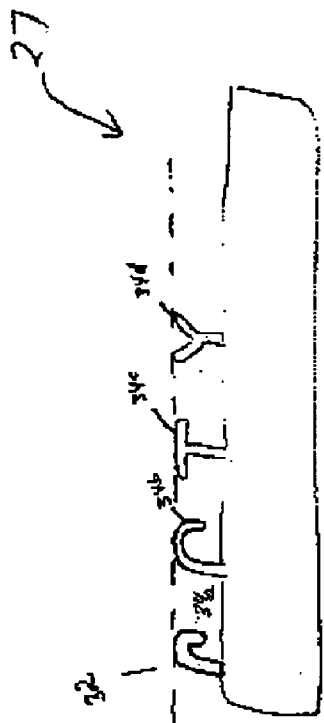


FIGURE 3b

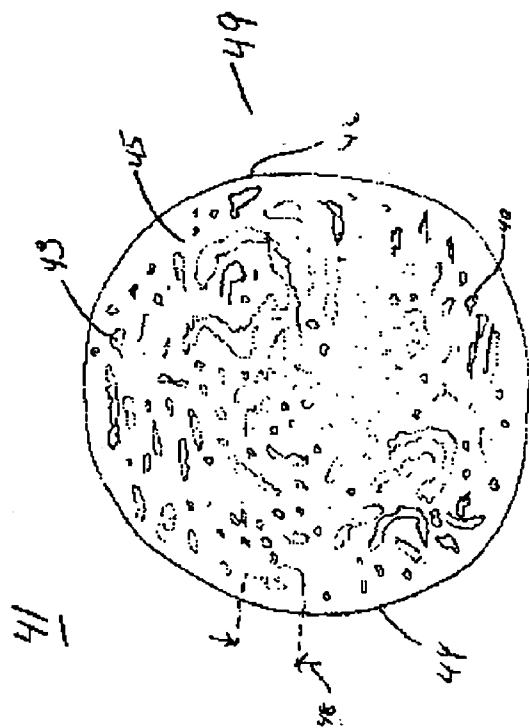


FIGURE 4B



FIGURE 4A

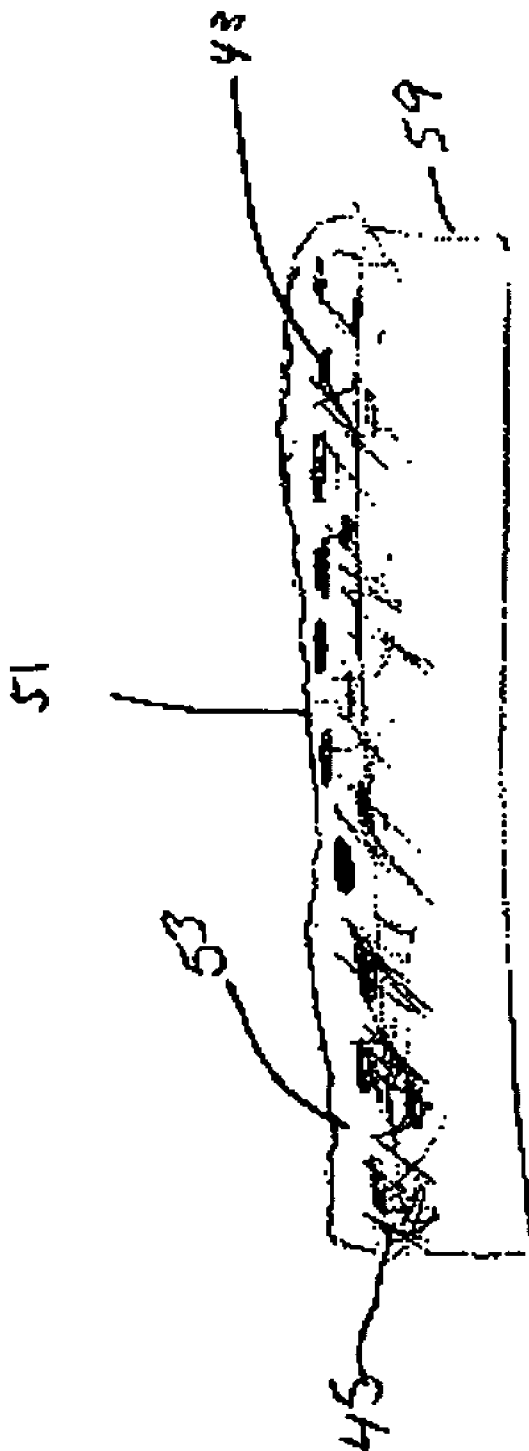


FIGURE 5

MATERIAL FOR MECHANICAL SKIN RESURFACING TECHNIQUES

BACKGROUND OF THE INVENTION

[0001] With advances in nutrition and medical treatment, the life expectancy of the average U.S. and world citizen has increased dramatically. As a result, large portions of those populations suffer from the associated effects of aging, including an increasing number of skin health issues. Though seldom life threatening, skin health issues can be uncomfortable and may cause chronic disabilities. In addition, because the skin is so visible, skin health issues and cosmetic skin conditions can lead to psychological stress in the patients who have them. These factors have driven people to seek improved solutions to health care and skin care.

[0002] Numerous techniques have been proposed to provide cosmetic and/or or skin rejuvenation benefits. One of the more popular techniques, professional microdermabrasion, is a non-invasive procedure in which a device pulls the skin via suction and bombards the skin with abrasive particles in order to affect an exfoliation. Professional microdermabrasion devices, however, are cumbersome in that they occupy a large amount of space and also require a high power input and must be plugged into an AC outlet during operation. Furthermore, the patient must make regular visits to the professional skin care specialist where he or she receives treatment. Accordingly, "at home" microdermabrasion systems that combine a motorized device and an abrasive system are now available.

[0003] Applicants have recognized that while "at-home" microdermabrasion systems are commercially available, these systems, while efficacious, may be less than optimal for various reasons. Available systems often employ an abrasive cream that may be costly and require effort to rinse from the skin. Other systems have attempted to simply provide a motorized platform to use commercially available skin cleansing pads without providing significant abrasive action to the skin. As such, it may be desirable to couple the microdermabrasion tool to a medium such as a carrier or pad to provide a pleasant and efficacious and cost-effective skin treatment, especially to a medium that is capable of transferring the mechanical action from the motorized device to the skin surface. Accordingly, a need exists for systems, articles such as pads, and methods that overcome one or more of the above-mentioned drawbacks.

SUMMARY OF THE INVENTION

[0004] In one aspect, embodiments of the invention relate to an article useful for abrasive treatment of skin. In a first embodiment, the article is suitable for transferring mechanical energy from a handheld device to skin placed in contact with the article, wherein the article has a Durable Abrasiveness from 2 to 14.

[0005] In another embodiment, the article is suitable for transferring mechanical energy from a handheld device to skin placed in contact with the article, and the article has a Durable Abrasiveness greater than 1, but less than about 14, and a Compressibility from about 7% to about 18%.

[0006] In another embodiment, the article is suitable for transferring mechanical energy from a handheld device to

skin placed in contact with the article, and the article has a Durable Abrasiveness greater than 1, but less than about 14, and a Displacement from about 0.15 mm to about 2 mm.

[0007] In another embodiment, the article is suitable for transferring mechanical energy from a handheld device to skin placed in contact with the article, and the article has a Displacement from about 0.15 mm to about 2.0 mm, preferably from about 0.25 mm to about 1 mm, more preferably from about 0.25 to about 0.8 mm, and most preferably from about 0.25 mm to about 0.5 mm; and the article has a maximum surface roughness from about 200 microns to about 3000 microns, preferably from about 300 microns to about 2000 microns, more preferably from about 350 microns to about 1500 microns, and even more preferably from about 400 microns to about 1200 microns.

[0008] In another aspect of the invention, a method of treating an expanse of skin includes imparting to an expanse of skin, mechanical energy via an apparatus comprising (1) a motor and (2) an skin-contactable element described in this Summary of the Invention; and contacting said expanse of skin with the skin-contactable element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A more particular description of the invention, briefly summarized above may be had by reference to the embodiments thereof that are illustrated in the appended drawings. It is to be so noted, however, that the appended drawings illustrate only typical embodiments of the invention and, therefore, are not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

[0010] FIG. 1 is a schematic side view of a system for treating the skin that is consistent with embodiments of the invention described herein;

[0011] FIG. 2 is a fragmented, schematic side view of an apparatus and a skin-contactable element having a loop-engageable surface, consistent with embodiments of the invention described herein;

[0012] FIG. 3A is a cross-sectional view of the loop-engageable surface of FIG. 2, showing protrusions thereon;

[0013] FIG. 3B is another embodiment of the loop-engageable surface of FIG. 2;

[0014] FIG. 4A is a cross-sectional view of a skin-contactable element consistent with embodiments of the invention described herein;

[0015] FIG. 4B is a top view of the skin-contactable element of FIG. 4A;

[0016] FIG. 5 is a cross-sectional view of a skin-contactable element consistent with embodiments of the invention described herein;

DETAILED DESCRIPTION OF THE INVENTION

[0017] It is believed that one skilled in the art can, based upon the description herein, utilize the present invention to its fullest extent. The following specific embodiments are to be construed as merely illustrative and not limiting the remainder of the disclosure in any way whatsoever.

[0018] As used herein the specification and the claims, the term “mechanical skin resurfacing technique” and variants thereof relate to the mechanically assisted removal of mammalian (especially human) skin cells, ranging from mild techniques (such as exfoliation and abrasive cleansing) through microdermabrasion, and up to severe techniques such as dermal abrasion.

[0019] As used herein the specification and the claims, the term “dermabrasion” and variants thereof relate to a non-thermal resurfacing technique especially well suited for deep defects of the skin such as acne scars, heavy wrinkles and the disfiguring effects of skin conditions like rosacea. The procedure involves the mechanical sanding of the upper layers of the skin and penetrates the skin deeper than microdermabrasion. With dermabrasion, a new layer of skin replaces the abraded skin during healing, resulting in a smoother appearance

[0020] As used herein the specification and the claims, the term “microdermabrasion” and variants thereof relate to a very mild and less-penetrating form of dermabrasion, more suited for reduction of fine lines and wrinkles and for other less severe skin conditions. Microdermabrasion penetrates less deeply into the skin, primarily the stratum corneum, or portions thereof.

[0021] As used herein the specification and the claims, the term “exfoliation” and variants thereof relate to the peeling and sloughing off of the skin’s tissue cells.

[0022] As used herein the specification and the claims, the term “cleansing” and variants thereof relate to removal of dirt, oils, and the like from the surface of the skin, especially through surfactant washing, and perhaps also penetrating into the pores of the skin. In “abrasive cleansing,” some degree of exfoliation also occurs.

[0023] These mechanical skin treatments may facilitate the delivery of benefit agents to skin tissue, e.g., cleansing and the delivery of acne treatment compositions or rejuvenating agents such as retinol.

[0024] As used herein the specification and the claims, the term “nonwoven” and variants thereof relate to a sheet, web, or bat of natural and/or man-made fibers or filaments, excluding paper, that have not been converted into yarns, and that are bonded to each other by any of several means. For additional clarification, nonwovens are distinct from woven and knitted fabrics. The fibers included in the nonwoven materials may be staple or continuous or be formed in situ, and preferably, at least about 50% of the fibrous mass is provided by fibers having a length to diameter ratio greater than about 300:1.

[0025] The present invention is directed to systems, articles, compositions, and methods useful for mechanical skin resurfacing techniques employing a handheld motorized device. In various embodiments of the invention, such systems, articles, and methods provide a unique combination of high reliability and convenience for the user, as well as a highly efficacious mechanical skin resurfacing technique.

[0026] Systems useful for mechanical skin resurfacing techniques according to embodiments of the present invention may vary with respect to presence or absence of various components or sub-assemblies; the size, shape, and selection of materials, and the like. For a description of various

systems for treating the skin and various portions of said systems, the reader is referred to co-pending published patent application, US2005-0148907, filed Dec. 24, 2003, entitled “TREATMENT OF SKIN USING A BENEFIT AGENT AND AN APPARATUS,” herein incorporated by reference. Of particular note are those sections entitled, “SKIN TREATMENT SYSTEM,” “MECHANICAL ENERGY DELIVERY SUB-ASSEMBLY,” “ACTUATION OF SKIN-CONTACTABLE SURFACE,” “CHEMICAL DELIVERY SUB-ASSEMBLY,” “INDICATOR,” “CONTROLLER,” “RECEIVING ELEMENT AND SENSING ELEMENT,” “WAVEFORM CONTROL,” “BENEFIT AGENTS,” “DIAGNOSTIC SUB-SYSTEM,” AND “METHOD OF USE.” FIG. 1 depicts one non-limiting example of a system 1 useful for mechanical skin resurfacing according to embodiments of invention described herein. The system 1 includes a motorized device 3 that is generally shaped to be held in a hand of user. The apparatus 3 may be of varying shapes and dimensions, and one notable shape includes a substantially tubular or cylindrical body 5. The apparatus 3 generally includes one or more surfaces 7 for removably attaching a skin-contactable element 9 thereto. The term, “removably attaching”, and variants thereof, relate to the ability to attach, remove, and reattach the element without significantly compromising the attachment strength. The skin-contactable element 9 (e.g., a sponge, a fibrous material or other material, or combinations thereof, including those described in this specification, below) includes a skin-contactable surface 11 for contacting the skin. The skin-contactable element 9 may be a part of a module 15 that includes the skin-contactable element 9 and an optional carrier 13. The optional carrier 13 (e.g., a firm plastic substrate) may be useful for removably attaching and detaching (e.g., via snap, threaded screw, friction fit or otherwise) the skin-contactable element 9 to the one or more surfaces 7 of the apparatus 3. A user grasping the body 5 may activate a motor (not shown in FIG. 1) within the apparatus 3, such as by actuating a switch 17 on the body 5. The motor, thereby activated, provides mechanical energy that is transmitted to the attached skin-contactable surface 11 and to an expanse of skin 19 (shown in phantom in FIG. 1) placed in contact therewith. The mechanical energy may be of various forms (e.g., vibration, rotation, reciprocation, and the like) that are transmitted via various means, e.g., an eccentric weight, a reciprocating shaft, and a rotating disc, among other means. The body 5 is generally shaped to facilitate easy grasping by the user so that the apparatus 3 is orient such that the attached skin-contactable surface 11 can contact the user’s skin.

[0027] In order to permit mechanical energy from the apparatus 3 to be readily, predictably, and comfortably transferred through the skin-contactable element to the skin and still permit the pad to conform to a variety of skin surfaces, including those skin surfaces that are curved or angled, the inventors have recognized that one or more of certain properties of the skin-contactable element are highly desirable. As such, skin can surprisingly be abrasively treated using pressure that is largely governed by the apparatus 3, to provide benefits such as cell proliferation, microdermabrasion efficacy, cleansing, and the like without causing undo damage to the skin, or problems rinsing loose abrasive from the skin. Furthermore, using the inventive skin-contactable element, unwelcome microbial growth within the element is limited.

[0028] The inventors have surprisingly found that one or more of the above-mentioned desirable attributes may be achieved by using moderately abrasive skin-contactable elements that have an appropriate Abrasiveness, either “Durable Abrasiveness” or “Plain Abrasiveness” determined according to the “Abrasiveness Test” described in the “Test Methods” section, below. Furthermore, the above-mentioned benefits are further enhanced if the skin-contactable elements are selected based upon their Abrasiveness in combination with one or more properties relating to how the pads behave under compressive load, specifically Compressibility and Displacement. These properties relate to the ability of the skin-contactable element to transfer the mechanical energy from the apparatus 3 to the skin-contacting surface in a moist or wet environment to mechanically resurface the skin.

[0029] In one embodiment, the skin-contactable element has a Durable Abrasiveness has a Durable Abrasiveness from 2 to 14, preferably from about 2.5 to about 12, more preferably from about 3 to about 10, even more preferably from about 4 to about 9.

[0030] The inventors have also found that moderately abrasive pads may be selected based upon their “Plain Abrasiveness.” In one embodiment, the skin-contactable element has a Plain Abrasiveness from 1 to about 5, preferably from 1 to about 2.

[0031] The inventors have also surprisingly found that moderately abrasive skin-contactable elements—particularly those meeting the fixed abrasiveness criteria as specified above, have enhanced performance when used in conjunction with a mechanical tool, when the skin-contactable element also has additional properties relating to their behavior under applied compressive load. In particular, the skin-contactable element provide some displacement under an applied load, but do not displace overly so.

[0032] Displacement of generally recoverable deformation due to an applied compressive force and Compressibility are additional properties useful to characterize the skin-contactable elements. These properties may be measured according to the “Compressibility and Displacement Test” described in the “Test Methods” section, below.

[0033] As such, in one embodiment, the skin-contactable element has a Displacement from 0.15 mm to about 2.0 mm, preferably from about 0.25 mm to about 1 mm, more preferably from about 0.25 to about 0.8 mm, and most preferably from about 0.25 mm to about 0.5 mm.

[0034] The inventors have also surprisingly found that moderately abrasive skin-contactable elements is compressible, but not overly so. As such, in one embodiment, the skin-contactable element has a Compressibility of less than about 20%. In other embodiments, the Compressibility may be less than about 19%, or more preferably less than about 15%. Most preferably, the Compressibility may range from about 3% to about 13%.

[0035] The inventors have also noted that it is desirable for the skin-contactable element to have a thickness that is from about 0.1 mm to about 20 mm, preferably from about 0.5 mm to about 5 mm, and more preferably from about 1 mm to about 5 mm, and most preferably from about 1.5 mm to about 4.5 mm. Thickness may be determined as the “Initial Thickness” in the Compressibility and Displacement Test, below.

[0036] Aside from the inventors findings regarding desirable Abrasiveness properties and desirable behavior under applied compressive load, the inventors have also noted that it is desirable for the skin-contactable element to have surface that is rough, but not overly so.

[0037] In one embodiment, the article has a maximum surface roughness from about 200 microns to about 3000 microns, preferably from about 300 microns to about 2000 microns, more preferably from about 350 microns to about 1500 microns, and even more preferably from about 400 microns to about 1200 microns. The article may include a fibrous material, such as one having an abrasive system bound thereto.

[0038] In another embodiment, the article has an average surface roughness from about 25 microns to about 300 microns, preferably from about 30 microns to about 200 microns, more preferably from about 35 microns to about 150 microns, and even more preferably from about 50 microns to about 100 microns.

[0039] FIG. 2 depicts an embodiment of system 1 in which a skin contactable element 29 comprises, consists essentially of, or consists of a fibrous material. Suitable fibrous materials include, without limitation, woven, nonwoven (oriented, e.g., via a carding process, or non-oriented), or knit fabrics. The fibers may be integrated into a nonwoven structure via, for example, needle punching, through-air bonding, hydro entangling, spun-bonding, chemical bonding (including adhesive bonding), or mechanical processing (such as embossing). The fibers may thereby be arranged into a freestanding fabric (e.g., a porous fabric). The nonwoven fabric may have an average pore diameter (as calculated via Cohen, “A Wet Pore-Size Model for Coverstock Fabrics,” Book of Papers: The International Nonwovens Fabrics Industry, pp. 317-330, 1990) that is from about 150 microns to about 500 microns, such as from about 220 microns to about 400 microns. A representative, non-limiting list of useful fibers includes fibers derived from organic polymers such as, for example, polyester, polyolefin, polyamide and rayon fibers and bicomponent fibers; cellulose-based fibers such as wood pulp, rayon, and cotton; and combinations thereof.

[0040] The inventors have found, in one embodiment of the invention, in order to provide an appropriate degree of Abrasiveness and Compressibility, the fibers are bonded via mechanical means such as a needle-punching process, known to those skilled in the art, such as to a thickness of about 0.5 mm to about 5 mm, more preferably from about 1 mm to about 5 mm. The fibrous material may have a basis weight (mass per unit area) sufficient to maintain its mechanical integrity for one or more uses of the skin contactable element 29. The basis weight may be, for example, between about 10 grams per square meter (gsm) and about 450 gsm, such as between about 200 gsm and about 400 gsm, preferably between about 300 and about 400 gsm. The fibrous material desirably includes rayon to provide softness and a strong, resilient material such as an olefin or polyester. One particularly notable fibrous material is a needle-punched blend of staple-length 1.5 denier “TENCEL” rayon and staple-length 4-5 denier PET available from Precision Custom Coating of Totowa, N.J., with a basis weight of about 200 gsm and about 400 gsm.

[0041] Referring again to FIG. 2, the fibrous material of the skin-contactable element 29 may be capable of remov-

ably attaching and detaching to a loop-engageable surface 27 on the apparatus 3. Once the loop-engageable surface 27 and the skin-contactable element 29 are engaged, the loop-engageable surface 27 is generally capable of firmly holding the skin-contactable element 29 in place throughout the time period during which the skin-contactable element 29 is brought in contact with the skin 19.

[0042] In one embodiment of the invention, the skin-contactable element 29 may have a peel strength required to separate the skin-contactable element from a loop-engageable surface (such as VELCRO USA, as hook no. 108 described below, as measured using an Instron) that is from about 100 grams per inch width to about 400 grams per inch width, such as from about 150 grams per inch width to about 250 grams per inch width. In one embodiment of the invention, the loop-engageable surface 27 is relatively smooth and non-abrasive, such that if the skin-contactable element 29 is misaligned (i.e., a portion of the loop-engageable surface 27 is exposed and thereby capable of contacting the skin 19), the loop-engageable surface 27 is not overly harsh to the skin 19. In one embodiment of the invention, the skin-contactable element 29 includes a buffer region 26 that is designed to “overhang” the loop-engageable surface 27 such that it is less likely, even with some misalignment of the skin-contactable element 29 and the loop-engageable surface 27, for portions of the loop-engageable surface 27 to contact the skin in use. The skin-contactable element 29 may have an area for contacting the skin that is greater than about 5 cm². In one preferred embodiment, the skin-contactable element 29 has a skin-contacting area for contacting the skin that is from about 5-50 cm², and more preferably about 11-50 cm².

[0043] The loop-engageable surface 27 may be secured onto the apparatus 3 in a permanent, irreversible manner such as by a layer 28 of adhesive. Alternatively, the loop-engageable surface 27 may be detachably/reattachably secured to the apparatus 3 as described in sections of this document below.

[0044] As shown in FIG. 3, the loop-engageable surface 27 generally includes a plurality of protrusions 31. While various shapes of the protrusions 31 are contemplated, in order to promote both firmness of hold to the skin-contactable element 29 during use, as well as ease of release from the skin-contactable element 29 when a user intentionally attempts to pull on the skin-contactable element 29 to detach it from the loop-engageable surface 27. The protrusions 31 may be rounded, such as mushroom-shaped, as shown in FIG. 3A or the protrusions may have other rounded shapes, such as shown in FIG. 3B, for example, curled (protrusion 34a), arcuate (protrusion 34b), T-shaped (protrusion 34c), Y-shaped (protrusion 34d) or otherwise configured to provide a high surface area per protrusion that may contact the skin 19 that abuts the loop-engageable surface 27. In another embodiment, the protrusions 31 are bent, angular, forked, hook-shaped, or the like to provide a somewhat stronger hold to the skin-contactable element 29.

[0045] Furthermore, in another embodiment of the invention, in order to promote softness, a height 39 of the protrusions may be relatively high, such that the skin 19 is less likely to feel discomfort in the situation where the loop-engageable surface 27 comes into contact with the skin 19. For example, the protrusions 31 may have height 39, e.g., an

average height, that is greater than about 0.05 mm, such as greater than about 0.10 mm, such as from about 0.15 mm to about 0.5 mm.

[0046] In one embodiment of the invention, the protrusions 31 have a spacing 35, e.g., an average unit spacing (center-to-center distance between a protrusion and its nearest neighbor considered from a top view) that is less than about 5 mm, more preferably less than about 2 mm, most preferably less than about 1 mm. In another embodiment of the invention, the protrusions 31 are present in a number density, e.g., an average number density, that is greater than about 0.25 protrusions per square millimeter (0.25/mm²), more preferably greater than about 0.50/mm².

[0047] Referring again to FIG. 3A, in another embodiment of the invention, also to promote softness and comfort upon inadvertent contact with the skin 19, the protrusions may have head regions 33 of the that have a diameter 37 that is relatively large. In one embodiment of the invention, the head regions 33 of the protrusions 31 have a diameter 37 that is greater than about 0.05 mm, more preferably greater than about 0.2 mm, most preferably from about 0.3 mm to about 1 mm.

[0048] In one embodiment of the invention, the protrusions 32 are configured such that each has a surface area capable of simultaneously contacting the skin that is at least about 0.002 mm², such as at least about 0.02 mm², such as from about 0.2 mm² to about 2 mm².

[0049] In yet another embodiment of the invention, the protrusions 32 have both a number density greater than about 0.25/mm² and a height greater than about 0.05 mm, more preferably a number density greater than about 0.5/mm² and a height greater than about 0.1 mm, even more preferably a number density greater than about 0.5/mm² and a height greater than about 0.15 mm.

[0050] Although various loop-engageable surfaces 27 may be suitable, one suitable fastener is commercially available as VELCRO, from Velcro USA, of Manchester, N.H. and has a mushroom shape protrusions with an average height of about 0.17 mm, an average unit spacing of about 0.4 mm; an average head diameter of 0.69 mm; and an a number density of about 5/mm². Note that for protrusions that have a head that is non-circular, as viewed from the top, an equivalent head diameter (“Deq”) may be calculated from the measured head area (“A”) as follows:

$$D_{eq}=(4A/\pi)^{1/2}.$$

[0051] Another suitable loop-engageable surface 27 has “Y”-shaped protrusions with an average height of about 0.37 mm (overall height) an average unit spacing of about 0.84 mm; an average head diameter of 0.37 mm; and an a number density of about 0.75/mm (commercially available from VELCRO USA, as hook no. 108).

[0052] FIG. 4A depicts a cross sectional view of another embodiment of a skin-contactable element 49. The skin-contactable element 49 is similar to the skin contactable element 29 depicted in FIG. 2; however, the skin-contactable element 49 includes an abrasive system 43 bound to a network of fibers 45.

[0053] The term an abrasive system “bound to fibers” refers to abrasive units, particles, aggregates, and the like that are firmly attached to the fibers and do not readily

separate in use therefrom. Such abrasive may be bound by various means; one notable means is by chemical bonding (including, without limitation, adhesive bonding).

[0054] The inventors have noted that, as depicted in FIG. 4A (cross-sectional view) and FIG. 4B (top view), according to one embodiment of the invention, the abrasive system 43 may include a plurality of discrete abrasive units 40, such as may be distributed among and/or across the fibers 45. In this embodiment of the invention, a skin contactable surface 41 includes both fiber and abrasive system.

[0055] This configuration may provide better microderm-abrasion efficacy than the configuration in which the abrasive system 43 is a continuous layer formed entirely across the fibers, extending continuously from one end 44 of the skin contactable element to a opposite end 46.

[0056] The discrete abrasive units 40 of the abrasive system 43 may be of varying shapes, e.g., substantially spherical, dendritic, and the like. The abrasive units 40 may have a maximum end-to-end dimension (i.e., the length of the longest line that can be drawn within one discrete abrasive unit 40) that is, for example, from about 0.2 mm to about 1 cm.

[0057] The abrasive system 43 may include or consist essentially of a water insoluble abrasive material such as an abrasive having a Mohs hardness of less than about 4. In one embodiment of the invention, the abrasive system includes a resin or polymer. For example, the polymer may be a homopolymer, copolymer, or terpolymer, and may be a blend of two or more different polymers. The polymers may be random, block, star, or other known architecture. The polymer may be made by known means, such as emulsion polymerization, dispersion, suspension, or solution polymerization. In a preferred embodiment the polymer is formed by emulsion polymerization. The polymers may be non-functional, or may contain functionality designed to optimize the properties of the coating in the specific application. One of skill in the art will be able to adjust monomer content and architecture to improve end-use performance of the polymer composition. The polymer could be a synthetic polymer, or could be a natural polymer such as, for example, a polysaccharide, starch, modified starch, or guar gum. Preferred polymers include homopolymers and copolymers having one or more of the following monomers: (meth)acrylates, maleates, (meth)acrylamides, vinyl esters, itaconates, styrenics, unsaturated hydrocarbons and acrylonitrile, nitrogen functional monomers, vinyl esters, alcohol functional monomers. Particularly preferred monomers include, but are not limited to, vinyl acetate; methyl (meth)acrylate, ethyl (meth)acrylate, butyl (meth)acrylate, ethylene, vinyl chloride, and styrene.

[0058] If included in the skin contactable element, the polymer is selected so as to provide enough hardness so as to be abrasive to skin, but not so hard as to cause scratching or discomfort. In one embodiment of the invention, the polymer has a glass transition temperature, T_g greater than about -20 degrees Celsius ($^{\circ}$ C.), such as from about 0° C. to about 105° C. In one notable embodiment, the polymer has a T_g from about 0° C. and about 50° C.

[0059] T_g can be determined by differential scanning calorimetry (DSC) conducted at a heating rate of 20.0° C./minute with 5 mg or smaller samples. The T_g is calculated

as the midpoint between the onset and endset of heat flow change corresponding to the glass transition on the DSC heat capacity heating curve. The use of DSC to determine T_g is well known in the art, and is described by B. Cassel and M. P. DiVito in "Use of DSC To Obtain Accurate Thermodynamic and Kinetic Data", American Laboratory, January 1994, pp 14-19, and by B. Wunderlich in Thermal Analysis. Academic Press, Inc., 1990.

[0060] The polymer may be a thermosetting polymer, (e.g., a polymer having crosslinks that are generally not reversible with changes in temperature). One notable polymer has an acrylic base/vinyl acrylic base that is partially crosslinked during cure with a T_g of about 30° C., e.g., VINAMUL ABX 30, resin commercially available as from Celanese Corporation of Dallas, Tex.

[0061] Applicants have noted that, in one embodiment of the invention, in order to provide a proper balance of skin treatment efficacy without causing a perception of harshness to the skin, the abrasive system preferably includes a polymer having a T_g from about 0° C. to about 50° C. Furthermore, Applicants have also noted that the abrasive system 43 that includes the polymer having a T_g from about 0° C. to about 50° C. is desirably present on the fibers such that the weight ratio of abrasive system to fiber is from about 5% to about 30%, more preferably from about 8% to about 23%, even more preferably from about 8% to about 18%, and most preferably from about 8% to about 12%.

[0062] While above, the abrasive system 43 is described as including a polymer, a polymer need not be present in the abrasive system 43. The abrasive system 43 may derive its abrasiveness from other means. For example, the abrasive system 43 may include an inorganic particle (e.g., aluminum oxide, pumice, and the like) that is bound to the fibers 45, such as by chemical bonding (e.g., via an organosilane, or via a polymer that is itself abrasive) or thermal bonding. In one embodiment, in order to reduce irritation to the skin, the inorganic particle has a Mohs harness of 3 or less, such as talc, gypsum, mica, or calcite.

[0063] The abrasive system 43 may further include one or more additional functional components compounded with the abrasive. Useful additional functional components include, but are not limited to plasticizers; cross-linkers; starch; polyvinyl alcohol; formaldehyde thermosetting agents such as melamine, urea, phenol; fillers; humectants; surfactants; salts; fragrances; and pigments or reflective agents. The additional functional components may be present in the abrasive system at from 0 to 20 percent by weight, and preferably from 5 to 15 percent by weight, calculated as a percent of the polymer solids.

[0064] The skin contactable element 49 may be formed by depositing the abrasive system 43 onto the fibers 45 by various means known to the art of industrial polymer coating, such as slot coating, foam coating, saturation, printing, or spraying. Spraying is particularly notable to facilitate the formation of discrete abrasive units on top of the fibers so that waste is reduced and efficacy is optimized. If the abrasive system 43 is applied by spraying, a sprayable composition that includes the abrasive system (e.g., polymer plus other functional ingredients as well as water or another suitable carrier) may be sprayed onto the fibers followed by drying the resulting fiber/abrasive composite in a conventional oven. Although, the foregoing relates to a skin-

contactable element that incorporates an abrasive system bound to the fibers, in one embodiment of the invention, the fibers themselves may be abrasive, without the need of including an additional abrasive system bound to the fibers. For example, in one particular embodiment, the skin-contactable element includes staple fibers that are integrated into a nonwoven structure via needle punching, through air bonding, or thermal bonding. The fibers may be high denier fibers formed from polyester; polyolefins; rayon fibers; bicomponent fibers; cellulose-based fibers such as wood pulp, rayon, and cotton; or combinations thereof.

[0065] One particular non-limiting example of skin-contactable element in which the fibers themselves provide the Abrasiveness (e.g., no abrasive system bound to the fiber is present) is one which includes (1) polyester fibers having a denier from about 5 to about 10, such as about 9, and a length from about 1 inch to about 2 inches; or (2) bicomponent fibers having a polyester or polypropylene core and a polyethylene core; with a denier from about 2 to about 6; or combinations thereof.

[0066] In another embodiment of the invention, the fibrous structure includes a layer of foam or other resilient material. For example, a laminate consisting of the nonwoven material described above with abrasives and formulations (call it material A), plus an added layer of foam material (call it B) for added loft and softness. The laminates could be arranged in several arrangements; A:B or A:B:A, or the B material could be under the loop-engageable fastener for some added compressibility for the system. One surface of B could be coated to be water/formulation impervious to prevent sucking up formulation.

[0067] In another embodiment of the invention, the skin-contactable element includes an apertured plastic film for providing abrasion to the skin. In this embodiment of the invention, the skin-contactable element may include or be free of fibers. For example, in one particular embodiment, the skin-contactable element includes a film such as one formed from an olefinic material such as polyethylene or polypropylene. In order to provide sufficient abrasion to the skin, high-density polyethylene and polypropylene are particularly preferred. Furthermore, the apertured plastic film may have a thickness prior to aperturing that is greater than about 1 mil, such as from about 1.5 mils to about 3 mils. Furthermore, to enhance abrasion, the film has apertures formed through the film and including protrusions that extend beyond a plane of the film thickness. The protrusions are designed to contact the skin of the user and to provide abrasion thereto. In order to provide a sufficient number of contact points for the skin, the apertured plastic film may have a plurality of apertures, such as may be generated by having an open area from about 20% to about 35%. The apertured plastic film may be formed by any of various methods known to the art (e.g., direct extrusion, vacuum, among others). A composite structure incorporating an abrasive surface may be formed by attaching a barrier film to a side of the apertured film that is oriented away from the skin of the user. One or more benefit agents may be contained within composite structure such that when the apertured contact the skin, the benefit agents are released from the composite structure and are available to contact or be absorbed by the skin.

[0068] FIG. 5 depicts a cross sectional view of another embodiment of a skin-contactable element 59. The skin-

contactable element 59 is similar to the skin contactable element 49 depicted in FIG. 4, however, the skin-contactable element 49 includes a coating 53 formed about or across the fibers 45, and, in one embodiment, as shown in FIG. 4, formed atop the fibers 45 and atop the abrasive system 43 as well. The coating 53 may be least partially water-soluble such that in use, one or more ingredients within the coating 53 dissolve in use and are transferred to the skin 19. In one embodiment of the invention, the coating 53 is substantially free of abrasive, such as abrasive particles that could be transferred to and embed in the skin. In one embodiment of the invention, the coating 53 is substantially free of water (i.e., includes less than about 2%, such as less than about 0.5% of water).

[0069] The coating may be formulated for one or more of various functions. For example, the coating may provide lubrication, emolliency or and/or moisturization; mild foaming; a vehicle to deliver various benefit agents (e.g., benefit agents, drugs, and the like); or combinations thereof. FIG. 5 depicts the embodiment wherein the coating 53 is a continuous coating that completely covers the fibers 45 and the abrasive system 43. In this embodiment of the invention, skin contactable surface 41 initially includes only coating 53. However, as the coating 53 dissolves, which can be quite rapid when placed in contact with moist skin, it permits the fibers 45 and abrasive system 43 to contact the skin.

[0070] The coating 53 need not be continuous and need not entirely cover either the fibers 45 or the abrasive system 43. As viewed from the top (not shown), the coating 53 may cover a significant portion of the entire top of the skin-contactable element 59, such as greater than about 20%, but less than 100%. In this embodiment of the invention, skin contactable surface 41 includes fibers 45, abrasive system 43, and coating 53.

[0071] The coating 53 may include various ingredients for conditioning and/or cleansing and/or providing foam. For example, the coating may include so-called "foaming" or "lathering" surfactants. As used herein, "lathering surfactant" means a surfactant, which when combined with water and mechanically agitated, generates a foam or lather. Such surfactants are preferred since increased lather is important to consumers as an indication of cleansing effectiveness. A wide variety of lathering surfactants are useful herein and include those selected from the group consisting of anionic lathering surfactants, nonionic lathering surfactants, cationic lathering surfactants, amphoteric lathering surfactants, and mixtures thereof.

[0072] For a detailed description of suitable formulations that may be used for the coating 53, the reader is referred to co-pending patent application Ser. No. 11/023,655, filed Dec. 28, 2004, entitled "SKIN TREATMENT ARTICLES AND METHODS," and, in particular, those sections entitled, "CLEANSING FORMULATIONS," "ANIONIC LATHERING SURFACTANTS," "NON-IONIC LATHERING SURFACTANTS," "CATIONIC LATHERING SURFACTANTS," "AMPHOTERIC LATHERING SURFACTANTS," "CONDITIONING FORMULATIONS," "HYDROPHOBIC CONDITIONING AGENTS," "HYDROPHILIC CONDITIONING AGENTS," "STRUCTURED CONDITIONING AGENTS," and "OTHER FORMULATIONS" herein incorporated by reference.

[0073] Furthermore, the coating 53 may include one or more benefit agents such as anti-acne agents, anti-wrinkle agents, anti-microbial agents, anti-fungal agents, anti-inflammatory agents, topical anesthetic agents, artificial tanning agents, accelerator agents, anti-viral agents, enzyme agents, sunscreen agents, anti-oxidant agents, skin exfoliating agents, depilatory agents, and the like. Other suitable benefit agents are described in co-pending published patent application US2005-0148907, filed Dec. 24, 2003, entitled "TREATMENT OF SKIN USING A BENEFIT AGENT AND AN APPARATUS," and co-pending patent application Ser. No. 11/023,655, filed Dec. 28, 2004, entitled "SKIN TREATMENT ARTICLES AND METHODS, both cited previously.

[0074] To enhance shelf-stability and flexibility of choices for packaging, the coating 53 may be substantially free of water (in this case, the pad could be wet with water before use). Alternatively, the coating and skin-contactable element 59 include substantial water or moisture and may be sealed in suitable packaging to prevent water loss to the external environment before use.

[0075] The coating 53 may be applied to the fibers such that the weight ratio of coating to fiber is from about 25.0% to about 100.0%, more preferably from about 25% to about 50%. The coating may be applied to the fibers or the fiber/abrasive composite by slot coating, foam coating, saturation, nip roll, and the like.

Methods of Use

[0076] System 1 of the present invention may be used to treat the skin, such as abrasive treatment, cleansing, or other skin treatments (e.g., acne, anti-aging, firmness, tone and texture, hair removal, body shaping/cellulite removal, and the like).

[0077] In one embodiment of the invention, the skin-contactable element is temporarily attached to the handheld motorized device (see, for example, FIG. 2). In an alternative embodiment, the adaptor is removably/replaceably attached to the apparatus and the skin-contactable element is removably attached to the adaptor (see, for example, FIG. 7). The motor is then activated, and the skin-contactable element is moved across the face or other expanse of skin to be treated. For example, a skin-contacting surface 21 (e.g., a substantially planar skin-contacting surface) is placed into contact with the skin to be treated. The skin-contactable element provides, for example, increased cell proliferation by abrasively treating the skin. The skin-contactable element may have incorporated therewith a formulation to provide emolliency, foam, or delivery of benefit agents to the skin. When the user is finished, the skin-contactable element may be removed and later replaced with a fresh one to provide a hygienic surface.

[0078] The system may be used with an additional composition (e.g., a cream or paste) to provide lubrication, deliver actives, or provide an overall aesthetic experience. The composition may be free of abrasives (pumice, oxides, etc.) that would otherwise potentially embed in the skin. Alternatively, the composition may include abrasives, however, in this embodiment, the user would preferably rinse the abrasive composition from the skin after the treatment is complete. The composition may be placed by the user (e.g., by dipping the skin-contactable element into the cream) on the skin-contactable element prior to activating the apparatus.

[0079] The inventors have discovered that by employing the skin-contactable element as well as related methods, and systems of the present invention, mechanical energy can be readily, predictably, and comfortably transferred through the skin-contactable element to the skin and still permit the pad to conform to a variety of skin surfaces, including those that are curved or angled. As such the skin can surprisingly be abrasively treated using controllable pressure to provide benefits such as cell proliferation, microdermabrasion efficacy, cleansing, and the like without causing undo damage to the skin or resulting in problems with rinsing loose abrasive from the skin. Furthermore, these embodiments can provide a disposable, hygienic, skin-contactable element that is economical to manufacture. Furthermore, the skin-contactable element may serve additional functions beyond providing abrasion, such as delivery of benefit agents, lubrication, and lathering.

[0080] The invention also permits abrasive treatment of the skin without the potential mess and inconvenience of a using an apparatus with a cream having dispersed abrasives particles, which may adhere to and embed in the skin.

Test Methods

Abrasiveness Test

[0081] "Durable Abrasiveness" is determined using the test method described below. The "Plain Abrasiveness" of a material is determined similarly to the Durable Abrasiveness, but the initial washing step is eliminated.

[0082] Five (5) samples of each of the skin-contactable elements to be tested are cut to a circular shape having a diameter of about 41 mm. Samples are individually rinsed with water in order to remove any materials such as foaming agents, oils, and emulsifiers that are readily separated from the article via contact with water. The cut samples are immersed in a bath of containing a mass of deionized water (temperature of about 35° C.) that has sufficient mass of water to be at least about 20 times the mass of the article. The article is allowed to remain in the bath for two minutes and is removed, allowed to drip for 10 seconds and then placed in another similar (fresh) water bath for two minutes, and again allowed to drip for 5 minutes. The sample is removed and allowed to dry at ambient temperature (at about 50-60% relative humidity) for a period from about 16 hours to about 72 hours. Again, this washing step is eliminated when measuring the Plain Abrasiveness.

[0083] After the sample is rinsed and dried as above, it is tested for abrasion using an abrasion testing device according to a modified version of ASTM test method D 3886-99. A suitable device is the CSI Universal Wear Tester, Model CS-226-605, available from Custom Scientific Instruments of Whippany, N.J. A sample of co-extruded spunbond/pigmented polyethylene film laminate (Clopay M18-1057, commercially available from Clopay Plastic Products of Mason, Ohio) is placed over the stage with the film oriented up, and the laminate is secured firmly against the stage with an o-ring, as supplied with the wear tester. The Clopay M18-1057 is a 26 gsm laminate having (1) a 15 gsm (nominal) spunbonded polypropylene nonwoven web layer that is coextruded with (2) a 20 gsm (nominal) polyethylene film having a thickness of about 0.7 mils (0.007 inches). The polyethylene film surface of the laminate is corona treated, and the laminate has a target bond strength of 150 grams per

inch. To determine bond strength, a one inch (1") wide specimen is sampled with its length dimension aligned in the machine direction. The operator initiates separation of the plies (the film and the nonwoven) by hand, and the plies are loaded into tensile test equipment having a 2" distance between grips. The plies are pulled apart at 30.5 cm/min speed and the force to separate them over a distance from 10 mm to 35 mm is averaged.

[0084] The sample to be tested is secured on the arm above the stage such that it aligns directly on top of the stage. The sample is secured (preferably by tough double-sided tape—e.g., PERMACEL tape available from Permacel Company of East Brunswick, N.J. in a manner such that the sample does not move when the tester is in operation. A 10 lb weight is loaded on the stage and the tester motor is powered. The stage simultaneously rotates and translates at a rate of about 130 cycles per minute. The number of cycles to failure is recorded as the first cycle in which the film is torn (for a pigmented, e.g., blue, film, the white spunbond readily shows through, marking the endpoint of the test. The process is repeated for the remaining samples. The average number of cycles to failure is recorded and a value for "Durable Abrasiveness" (for the washed samples) or for "Plain Abrasiveness" (for the unwashed samples) is calculated as 2000 divided by the average cycles to failure.

[0085] A standard sample, SCOTCH-BRITE Pad ("Heavy Duty Commercial Scoring Pad,"# 86) is desirably run as a standard with each data set. The SCOTCH-BRITE Pad, #86 should yield a Durable Abrasiveness value of approximately 33+/-4. If the operator determines a Durable Abrasiveness that falls outside this range, this signifies slight operator error, and the operator should adjust any subsequent determinations for Durable Abrasiveness by a factor that corrects for this operator error. That factor is (V/33), where V is the value determined by the operator for SCOTCH-BRITE Pad, # 86. If SCOTCH-BRITE Pad, # 86 is not available, then, as a substitute, SCOTCH-BRITE Pad ("General Purpose Commercial Scoring Pad,"#96") can be run as a standard, with the expected value of Durable Abrasiveness as 14+/-2 and a correction factor of (V/14) if this alternative standard does not fall within the prescribed range.

[0086] The Abrasiveness value for the five samples is averaged and reported as the Durable Abrasiveness or Plain Abrasiveness value for the particular skin-contactable element.

Compressibility and Displacement Test

[0087] "Displacement" is determined using the following test method: for each article to be tested, five samples are cut to a size of about 41 mm diameter. One at a time, a sample is placed on a thickness gauge such as the Ames Logic Plus (model LG3601-1-04) available from BC Ames of Waltham, Mass., and the sample is centered under the 55 mm foot. A 0.5 oz weight is placed on the shaft and the foot is gently lowered onto the sample. The "Initial Thickness" reading is taken after the gauge is allowed to stabilize for 10 seconds. Next, the foot is lifted, the 0.5 oz. Weight is replaced with an 8 oz weight. After the gauge is allowed to stabilize for 10 seconds, the "Thickness Under Load" is recorded. The process is repeated for 10 samples. For each sample the difference between Initial Thickness and Thickness Under Load is calculated and recorded. The result for the 10 samples is averaged and recorded as the Displacement for the particular skin-contactable element.

[0088] "Compressibility" is calculated as the Displacement of a sample divided by its Initial Thickness and expressed as a percent. The result for the 10 samples is averaged and recorded as the Compressibility for the particular skin-contactable element.

Surface Roughness Test

[0089] Surface Roughness is readily determined using an optical instrument designed to measure surface features such as the Optical 30 Skin Measurement Device Primos Compact, commercially available from GF Messtechnik GmbH of Teltow, Germany. In order to determine both maximum and average surface roughness, one may utilize software commercially available with the device. A sample to be measured is placed on a flat surface such as a bench top (taped down if necessary), brought into focus, and a surface area of about 25 mm to 30 mm is scanned according to "star roughness," (radial) profile. An 8-rank polynomial is fit to the surface in order to determine the roughness parameters. Maximum surface roughness and average surface roughness are determined using the software interface.

EXAMPLES

[0090] The following examples relate to skin-contactable elements of the present invention. Other embodiments of the invention can be prepared in an analogous manner by a person of ordinary skill in the art.

Examples 1-3

[0091] A freestanding fibrous, non-woven material (a needle-punched blend of 55% lyocell and 45% polyester, having a basis weight of about 200 gsm and a thickness of about 2.5 mm, available from Precision Custom Coating of Totowa, N.J., USA) was sprayed with an abrasive composition to form a skin-contactable element. The abrasive composition contained an abrasive system which was a blend of about 95.7% by weight of ABX 30 RESIN, (approximately 50% by weight of which is polymer), available from Celanese Corporation of Dallas, Tex., about 4% mica (Prestige Sparkling Silver with a particle size from 20-150 microns, available from Ekhart America L.P of Painesville, Ohio) and about 0.3% of polyacrylic acid thickener, ALCOGUM 296W, available from Alco chemical. Sufficient water was added to permit the composition to be sprayed onto the non-woven to provide a concentration by weight of abrasive system to non-woven described in the Table below. The non-woven with the composition applied thereto was then dried in a conventional oven. The abrasive system was present to a large degree on the surface of the non-woven fibers.

Example	wt-% abrasive system
1	8
2	12
3	24

[0092] The non-woven/abrasive composite was then cut into circular pads having a diameter of 41 mm. A conditioning composition was then coated across the entire top surface of the composite non-woven/abrasive system. The

conditioning composition included the following ingredients:

Trade Name	Chemical Name	% (w/w)
Texapon NC70	Sodium Laureth Sulfate	8.7000
Tegobetaine F-50	Cocamidopropyl Betaine	3.4800
Plantaren 2000 N	Decyl Glucoside	2.9000
Monateric 949J	Disodium Lauroamphodiacetate	4.0600
Atlas G-4280	PEG-80 Sorbitan Laurate	11.6000
Glucquat 125	Lauryl Methyl Gluceth-10	0.5800
	Hydroxypropyldimonium Chloride	
Phenoxetol	Phenoxyethanol	0.5220
Nipa Butyl	Butyl Paraben	0.0435
Methyl Paraben	Methyl Paraben	0.0899
Propyl Paraben	Propyl Paraben	0.0580
Fragrance	Fragrance	0.3480
Citric Acid anhydrous	Citric Acid	0.1160
Carbowax PEG 400	Citric Acid	6.3626
Emery 917	Glycerin	19.1400
Frescolate ML Crystal	Menthyl Lactate	2.0000
Cutina WW9	Cocoglycerides	40.0000
	Glyceryl stearate	
	Glyceryl laurate	
	Stearyl alcohol	
	Myristic acid	

The conditioning composition was coated in the laboratory using a tongue depressor, on the non-woven/abrasive composite such that each 4" diameter pad had about 0.75 grams of conditioning composition coated thereon to form a skin-contactable element.

[0093] An adaptor was made by thermoformed PETG plastic, similar to the embodiment of the invention depicted in FIG. 7. A loop engageable attachment was permanently bonded on the top flat surface of the adaptor. The skin-contactable element was mounted on an adaptor by placing the skin-contactable element on the loop-engageable surface and pressing firmly.

Example 4

[0094] A skin-contactable element was made in a manner identical to Example 2, except that a cleansing composition (detailed below) was applied to the non-woven/abrasive composite rather than the conditioning composition detailed above.

Trade Name	Chemical Name	% (w/w)
Texapon NC70	Sodium Laureth Sulfate	15.0000
Tegobetaine F-50	Cocamidopropyl Betaine	6.0000
Plantaren 2000 N	Decyl Glucoside	5.0000
Monateric 949J	Disodium Lauroamphodiacetate	7.0000
Atlas G-4280	PEG-80 Sorbitan Laurate	20.0000
Glucquat 125	Lauryl Methyl Gluceth-10	1.0000
	Hydroxypropyldimonium Chloride	
Phenoxetol	Phenoxyethanol	0.9000
Nipa Butyl	Butyl Paraben	0.0750
Methyl Paraben	Methyl Paraben	0.1550
Propyl Paraben	Propyl Paraben	0.1000
Fragrance	Fragrance	0.6000
Citric Acid anhydrous	Citric Acid	0.2000
Carbowax PEG 400	Polyethylene glycol	10.9700
Emery 917	Glycerin	33.0000

[0095] The PEG-80 Sorbitan Laurate and Disodium Lauroamphodiacetate were added together in a beaker and mixed until homogenous. The butylparaben, methylparaben, and propylparaben were added thereto and slowly mixed until the parabens dissolved. The PEG-8 and glucquat were then added to the beaker and mixed. The Cocamidopropyl Betaine, Sodium Laureth Sulfate, Decyl Glucoside, and Phenoxyethanol were then added and mixed. The fragrance was then added. The citric acid was then added and the ingredients mixed until the citric acid was completely dissolved. The pH was adjusted to between 6.4 to 7.2

Example 5

[0096] The skin-contactable elements of Examples 1-3 were mounted on an apparatus for abrasively treating the skin using the adaptor described in Example 1. The motorized device is commercially available from Neutrogena Corporation (Los Angeles, Calif.) as an applicator of a microdermabrasion system under the name, "NEUTROGENA Advanced Solutions™ At Home MicroDermabrasion System." The speed setting used was the "high" setting.

[0097] A clinical assessment was performed in which 16 subjects performed a microdermabrasion treatment once per day in their homes. Each subject tested the systems described in Examples 1-3 on a particular spot on his or her forearm. At days 1, 5, and 10, the subjects were clinically evaluated for cell proliferation (in a manner similar to that described in U.S. Pat. No. 5,456,260, "Fluorescence detection of cell proliferation," assigned to General Hospital Corporation, and incorporated herein by reference), trans-epidermal water loss, moisturization, and hydration. The results are shown below.

Example 6

[0098] A nonwoven pad identified as 85 gsm spunbond and consisting of three layers (including 20% polyester, 80% rayon) having a pattern of raised dots having EVA binder coated on the dots; available from Green Bay Nonwovens as SX-247 was provided. This was cut into 41 mm diameter pads to which 0.75 grams of cleansing composition was applied thereon, in a manner similar to Example 1, to form a skin-contactable element.

Example 7

[0099] The skin-contactable element of Example 4 and the skin-contactable element of Example 6 were tested for cell proliferation in a manner similar to that described in Example 5. The subjects were evaluated after 5 days of treatment. A comparison of the results shows a % increase in cell proliferation over baseline skin of about 52% for the pad of Example 4 as compared to about 33% for the pad of example 6. The pad of Example 4 showed superior cell proliferation versus the pad of comparative example 6.

Example 8

[0100] A skin-contactable element formed in the same manner as described in Example 4, except that the non-woven fibrous material had a basis weight of about 300 gsm and the concentration of abrasive system applied was increased to 11%, yielding a basis weight of abrasive system associated with the pad of about 34 gsm (1 ounce per square yard).

Example 9

[0101] A skin-contactable element formed in the same manner as described in Example 4, except that the non-woven fibrous material had a basis weight of 400 gsm and the concentration of abrasive system applied was increased to 8.3%, yielding basis weight of abrasive system of about 34 gsm (1 ounce per square yard).

Example 10

[0102] The skin-contactable element of Example 8 and Example 9 were tested for cell proliferation similar to Example 7, except that treatments were performed on both the volar forearm and the face. The subjects were evaluated after 1 week and 2 weeks of treatments. On the face, the skin-contactable element of Example 8 provided greater cell proliferation (about 47%) at 2 weeks than the skin-contactable element of Example 9 (about 29% cell proliferation).

Example 11

[0103] A skin-contactable element similar to that described in Example 8, except that a concentration of abrasive system of about 17.7% was used, resulting in a abrasive system basis weight of about 1.6 ounces per square yard. The skin-contactable element was otherwise similar. The sample was analyzed for surface roughness using the Primos Skin Measuring Device described previously. The maximum surface roughness was about 758 microns. The average surface roughness was about 94.6 microns.

Comparative Example 12

[0104] A sample of OLAY Total Effects Daily Cleansing Treatments (available from Procter and Gamble of Cincinnati, Ohio) was analyzed for surface roughness using a similar manner as described above. The maximum surface roughness was about 180 microns. The average surface roughness was about 21 microns.

Comparative Example 13 (C13)

[0105] SCOTCH BRITE pad # 86 was evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are provided in Table 1 below.

Comparative Example 14 (C14)

[0106] SCOTCH BRITE pad # 96 was evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are provided in Table 1 below.

Comparative Example 15 (C15)

[0107] BRILLO Scrub and Toss, commercially available from Church & Dwight of Princeton, N.J. was evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are provided in Table 1 below.

Examples 16-18 (E16-E18)

[0108] Skin-contactable elements with varying basis weight of fiber and abrasive system were prepared. No cleansing formulation was applied to the pads. They were otherwise identical to the skin-contactable element described in Example 1. These were evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are provided in Table 1 below.

Examples 19-20 (E19-E20)

[0109] Skin-contactable elements with varying basis weight of fiber and abrasive system were prepared. No cleansing formulation was applied to the pads. They were otherwise identical to the skin-contactable element described in Example 1. These were evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are provided in Table 1 below.

Example 21 (E21)

[0110] A skin contactable element was prepared similarly to Example 4, except that the basis weight of fiber was 300 gsm pad and the basis weight of abrasive system was 1.6 osy. These were evaluated for Displacement, Compressibility, Durable Abrasiveness, and Plain Abrasiveness. The results are provided in Table 1 below.

Comparative Example 22

[0111] The skin contactable element of Example 6 was evaluated for Displacement, Compressibility, Durable Abrasiveness, and Plain Abrasiveness. The results are provided in Table 1 below.

Comparative Example 23

[0112] OLAY Total Effects Daily Cleansing Treatments (available from Procter and Gamble of Cincinnati, Ohio) was evaluated for Displacement, Compressibility, and Durable Abrasiveness. The results are reported in Table 1 below.

TABLE 1

Ref.	Skin-Contactable Element, Identifier	Displacement (mm)	Compression (%)	Durable Abrasiveness	Plain Abrasiveness
C13	SCOTCH-BRITE #86	4.0	28.5	33.3	—
C14	SCOTCH-BRITE #96	2.3	20.7	14.3	—
C15	BRILLO SCRUB N TOSS	0.43	12.3	20.8	—
E16	200 gsm pad/25.5 gsm abrasive system	0.41	15.0	3.1	—
E17	300 gsm pad/32 gsm abrasive system	0.52	11.9	7.8	—
E18	400 gsm pad/32 gsm abrasive system	0.26	6.9	4.0	—

TABLE 1-continued

Ref.	Skin-Contactable Element, Identifier	Displacement (mm)	Compression (%)	Durable Abrasiveness	Plain Abrasiveness
E19	300 gsm pad/13.6 gsm abrasive system	—	—	3.7	—
E20	300 gsm pad/20 gsm abrasive system	—	—	5.6	—
E21	300 gsm pad/54 gsm abrasive system	0.36	8.8	4.9	1.2
C22	GREEN BAY	0.21	16.1	<1	—
C23	OLAY TOTAL EFFECTS	0.12	20.0	1.7	—

What is claimed is:

1. An article suitable for transferring mechanical energy from a handheld device to skin placed in contact with said article, said article having a Durable Abrasiveness from 2 to 14.
2. The article of claim 1, wherein said article has a Displacement from about 0.2 mm to about 2.0 mm.
3. The article of claim 2, wherein said article has a Displacement from about 0.25 mm to about 1.0 mm.
4. The article of claim 3, wherein said article has a Displacement from about 0.25 mm to about 0.8 mm.
5. The article of claim 1, wherein said article has a Compressibility of less than about 20%.
6. The article of claim 5, wherein said article has a Compressibility of less than about 15%.
7. The article of claim 6, wherein said article has a Compressibility from about 3% to about 13%.
8. The article of claim 1, wherein said article has a thickness from about 1.5 mm to about 4.5 mm.
9. The article of claim 1, wherein said article has a maximum surface roughness from about 200 microns to about 3000 microns.
10. The article of claim 9, wherein the article has a maximum surface roughness from about 350 microns to about 1500 microns.
11. The article of claim 1, wherein the article has an average surface roughness from about 25 microns to about 300 microns.
12. The article of claim 1, wherein the article has a Durable Abrasiveness from about 3 to about 10.
13. The article of claim 1, wherein the article, wherein the article comprises fibers.
14. The article of claim 13, wherein the article comprises needle-punched fibers.

15. The article of claim 13, wherein the article comprises fibers and an abrasive system bound to the fibers

16. An article suitable for coupling to a handheld device for contacting the skin, said article having a Durable Abrasiveness between about 1 and about 14, and a Compressibility from about 7% to about 18%.

17. An article suitable for coupling to a handheld device for contacting the skin, said article having a Durable Abrasiveness between about 1 and about 14, and a Displacement from about 0.15 to about 2.

18. An article suitable for coupling to a handheld device for contacting the skin, said article having a Displacement from about 0.15 mm to about 2.0 mm and a maximum surface roughness from about 350 microns to about 1500 microns.

19. A disposable pad for use in mechanical skin resurfacing techniques comprising

- a. A first, skin-contacting surface;
- b. A second surface, substantially opposite the first, arranged and configured for releasable attachment to a handheld device;

wherein the first surface of the pad has a Durable Abrasiveness from 2 to 14.

20. A method of treating an expanse of skin, comprising:

- a. imparting to said expanse of skin, mechanical energy via an apparatus comprising a motor and the skin-contactable element of claim 1; and
- b. contacting said expanse of skin with said skin-contactable element.

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